AMERICAN MUSEUM
Novitates

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CENTRAL PARK WEST AT 79TH STREET, NEW YORK, NY 10024
Number 3254, 25 pp., 11 figures, 4 tables December 21, 1998

New Cascudinhos from Southern Brazil: Systematics, Endemism, and Relationships (Siluriformes, Loricariidae, Hypoptopomatinae)

ROBERTO E. REIS[1] AND SCOTT A. SCHAEFER[2]

ABSTRACT

Epactionotus, a new genus of the loricariid catfish subfamily Hypoptopomatinae with three new species, and a new species of *Eurycheilichthys* are described from southern Brazil. *Epactionotus* is diagnosed among genera of the Hypoptopomatinae by the posterior position of the dorsal fin and morphology of its internal supports and by absence of an expanded fleshy flap on the dorsal surface of the first pelvic-fin ray of males. The three *Epactionotus* species are each endemic to a very limited geographic area along the Atlantic coast of southern Brazil. *Epactionotus bilineatus* n. sp. is restricted to the rivers Maquiné and Três Forquilhas in northeastern Rio Grande do Sul State, *E. itaimbezinho* n. sp. is endemic to the rio Mampituba along the border between Rio Grande do Sul and Santa Catarina States, and *E. gracilis* n. sp. is endemic to the rio Araranguá drainage of southern Santa Catarina State. These new species are distinguished based on morphometric comparisons, color pattern, and arrangement of abdominal platelets. *Eurycheilichthys limulus* n. sp. is described from the upper reaches of the rio Jacuí drainage in Rio Grande do Sul State. This new species shares with its sole congener, *E. pantherinus,* a single synapomorphy, presence of seven branched pectoral-fin rays, and is distinguished from it by a more narrow body, head and dorsal trunk with series of longitudinal light stripes, versus scattered dark blotches, and presence of an accessory ceratobranchial flange and filamentous gill rakers, versus absence of those features in *E. pantherinus*. In addition to the presence of longitudinal stripe coloration and accessory teeth, these four species also share with several other, but not all hypoptopomatines, a peculiar slitlike morphology of the skin at the base of the pectoral-fin spines, the function and biological significance of which is unknown.

---

[1] Laboratório de Ictiologia, Museu de Ciências e Tecnologia da PUCRS, Av. Ipiranga, 6681; 90619-900 Porto Alegre, RS, Brazil. E-mail to reis@music.pucrs.br.

[2] Associate Curator, Department of Ichthyology, American Museum of Natural History. Reprint requests to schaefer@amnh.org.

Copyright © American Museum of Natural History 1998 ISSN 0003-0082 / Price $3.00

RESUMO

Epactionotus, um novo gênero de Loricariidae da sub-família Hypoptopomatinae com três novas espécies, e uma nova espécie de *Eurycheilichthys* são descritos do sul do Brasil. *Epactionotus* é diagnosticado entre os gêneros de Hypoptopomatinae pela posição relativa da nadadeira dorsal e morfologia do seu suporte interno, e pela ausência de uma prega carnosa expandida na superfície dorsal do primeiro raio da nadadeira pélvica dos machos. As três espécies de *Epactionotus* são endêmicas de uma estreita área ao longo da costa Atlântica do sul do Brasil. *Epactionotus bilineatus* sp.n. é restrito aos rios Maquiné e Três Forquilhas, no nordeste do Rio Grande do Sul, *E. itaimbezinho* sp.n. é endêmico do rio Mampituba, no limite entre Rio Grande do Sul e Santa Catarina, e *E. gracilis* sp.n. é endêmico da bacia do rio Araranguá no sul de Santa Catarina. Estas novas espécies são distinguidas com base em comparações morfométricas, padrão de colorido e arranjo das placas abdominais. *Eurycheilichthys limulus* sp.n. é descrito da porção superior do rio Jacuí, no Rio Grande do Sul. Esta nova espécie compartilha com seu único congênere, *Eurycheilichthys pantherinus*, uma única sinapomorfia, a presença de sete raios ramificados na nadadeira peitoral. A nova espécie é distinguida por seu corpo mais estreito, cabeça e porção dorsal do tronco com uma série de faixas longitudinais claras versus manchas arredondadas escuras, e presença de uma lâmina acessória no primeiro ceratobranquial e de rastros filamentosos, versus ausência destas características em *E. pantherinus*. Em adição à presença da coloração com faixas longitudinais e dentes acessórios, estas quatro espécies também compartilham a presença de um poro peitoral na pele da base do espinho peitoral, cuja função e significado biológica é ainda desconhecida.

INTRODUCTION

The siluriform family Loricariidae, with more than 650 described species, is the largest family of catfishes and includes more than one-quarter of the total number of catfish species in the world. The subfamily Hypoptopomatinae, with more than 70 species, represents approximately one-tenth of all loricariid species and has received increased attention from systematists in the last decade. The subfamily group was established by Eigenmann and Eigenmann (1890: 388, their Hypoptopominae, name subsequently emended without comment by Regan, 1904: 195, 262) to include *Hypoptopoma* Günther, 1868, *Otocinclus* Cope, 1871, *Hisonotus* Eigenmann and Eigenmann, 1889, *Microlepidogaster* Eigenmann and Eigenmann, 1889, and *Parotocinclus* Eigemann and Eigenmann, 1889. *Oxyropsis* Eigenmann and Eigenmann, 1889 was placed in the subfamily Loricariinae by those authors, whereas Regan (1904) placed *Oxyropsis* in the synonymy of *Hypoptopoma*. *Pseudotocinclus* Nichols, 1919, and *Otothyris* Myers, 1927, were established subsequently and, after an interval of more than 50 years, Britski and Garavello (1984) described *Schizolecis* and *Pseudotothyris* from southeastern Brazil. Isbrücker (1987) transferred *Acestridium* Haseman, 1911, from the subfamily Loricariinae to the Hypoptopomatinae.

Schaefer (1991) presented a phylogenetic analysis of the genera in the subfamily Hypoptopomatinae, assigned genera to the tribes Hypoptopomatini and Otothyrini, and provided phylogenetic diagnoses for the included genera plus an undescribed genus from Venezuela, subsequently described as *Niobichthys* (Schaefer and Provenzano, 1998). Reis and Schaefer (1992) described *Eurycheilichthys*, placing it in the tribe Otothyrini, and Schaefer (1996) described *Nannoptopoma* in the tribe Hypoptopomatini. Schaefer (1997) revised *Otocinclus* and proposed a biogeographic hypothesis based on the phylogenetic relationships among the included species. Britski (1997) described *Corumbataia* and suggested it be placed in the Otothyrini. Garavello et al. (1998) revised *Otothyris* and described three new species. Schaefer (1998) resurrected *Hisonotus* Eigenmann and Eigenmann from synonymy with *Microlepidogaster*, provided evidence of at least four additional undescribed generic-level taxa, and revised the generic-level phylogenetic relationships within the subfamily.

Judging from the large amount of descriptive taxonomic work conducted in the last ten years, the generic and species-level diversity of the hypoptopomatine loricariids is much greater than had previously been acknowledged and their present classification does not adequately reflect the evolutionary history of speciation and diversification within the clade. Fish collections made in southern Brazil during the last ten years have also revealed a number of undescribed hypoptopomatines from both the Uruguay basin and the smaller coastal drainages. *Eurycheilichthys pantherinus* Reis and Schaefer, 1992, was recently described from the upper reaches of the rio Uruguay drainage of Brazil. In this paper, a second species of *Eurycheilichthys*, *E. limulus* ("New Taxon 1" of Schaefer, 1998) is described from the upper portion of the rio Jacuí. We also describe a new genus ("New Taxon 2" of Schaefer, 1998) with three new species that are each endemic to separate coastal streams of the Serra Geral formation in northeastern Rio Grande do Sul and southern Santa Catarina States of Brazil.

The four new species described herein, along with most but not all members of the Hypoptopomatinae, share a peculiar slitlike morphology of the skin at the pectoral spine base. We had originally thought that this pectoral slit might be an artifact of specimen preservation; however, upon closer examination and comparison of the morphology across loricariid genera, we now believe this condition to be normal, rather than a teratology or artifact. Our purpose here is to briefly describe the slit morphology and note its occurrence among hypoptopomatine genera, reserving a more thorough treatment for a subsequent paper, once we complete additional study.

METHODS

Counts and traditional measurements follow Boeseman (1968: fig. 5) and Reis and Schaefer (1992). Five vertebrae are incorporated into the fused Weberian complex of loricarioids (Chardon, 1968; Schaefer, 1987) and the sixth is the first separate and unconsolidated post-Weberian vertebra. Standard length (SL) is used throughout. Head length (HL) was measured from the snout tip to the posterior supraoccipital tip. Measurements were taken with an electronic Mitutoyo caliper and recorded to the nearest 0.1 mm. Geometric morphometric methods were used to discriminate species based on head shape. Morphometric data were acquired as homologous landmark coordinates on the dorsal surface of the head using a video image analysis system. Specimens were digitized as image files and landmark coordinate data acquired using the software TpsDig (version 1.08) by F. James Rohlf. Twelve landmarks were digitized per specimen in dorsal view: (1) snout tip at midline; (2) anterior margin of penultimate right cheek plate; (3) anterior margin of penultimate left cheek plate; (4) inner margin of anterior right nostril; (5) inner margin of anterior left nostril; (6) anterior margin of right orbit; (7) posterior margin of right orbit; (8) anterior margin of left orbit; (9) posterior margin of left orbit; (10) posterior tip of right cleithral process; (11) posterior tip of left cleithral process; (12) posterior supraoccipital tip. We performed a relative warps analysis using the software Relative Warps (version 1.10) by F. James Rohlf to examine the extent to which the landmark data reveal phenetic clusters of individuals, interpreted here as putative species. The method of relative warps (see Bookstein, 1991 and Rohlf, 1993 for methodological details and practical applications) computes a consensus configuration (least-squares Procrustes average configuration) based on the landmark coordinates of all specimens. Shape differences between the consensus landmark configuration and each individual specimen were obtained as represented by the matrix of partial warp scores. Relative warps scores were computed by principal components analysis of the covariance matrix of the partial warps scores, with the α parameter (Rohlf, 1993) set to zero to give equal weight to partial warps at all spatial scales. The uniform shape component, calculated by the linearized Procrustes superimposition method (Bookstein, 1996), was included in the matrix of partial warp scores.

Osteological preparations were made following Taylor and Van Dyke (1985). In the listing of material examined, we follow Menezes and Weitzman (1990) and Reis (1997) in the style used in listing of Brazilian geographic entities and locality names in Portuguese; cleared and counterstained specimen are denoted as cs.

Institutional abbreviations

ANSP	Academy of Natural Sciences of Philadelphia, USA
MCN	Fundacão Zoobotanica do Rio Grande do Sul, Brasil
MCP	Museu de Ciências da Pontificia Universidade Católica do Rio Grande do Sul, Brasil
USNM	National Museum of Natural History, Smithsonian Institution, Washington, DC, USA

SYSTEMATIC ACCOUNTS

Epactionotus, new genus

TYPE SPECIES: ***Epactionotus bilineatus,*** new species.

DIAGNOSIS: Three derived features diagnose *Epactionotus* among the Hypoptopomatinae: (1) neural spine of seventh vertebra not contacting nuchal plate dorsally, but rather contacting unpaired predorsal plate anterior to nuchal plate; (2) dorsal fin located more posteriorly relative to supraoccipital, its first proximal radial contacting eighth vertebra, rather than seventh vertebra as in all other Hypoptopomatinae (except *Microlepidogaster*, where first dorsal-fin proximal radial contacts vertebra 9); and (3) absence of expanded fleshy flap on dorsal surface of first pelvic-fin ray of males (flap absent in females, present and independently derived in males of *Epactionotus*, *Schizolecis,* and in a subclade of the Hypoptopomatini; see Schaefer, 1998). Additional features useful to further distinguish this genus are presence of dentary and premaxillary accessory teeth (see Reis and Schaefer, 1992: fig. 5) and the head and trunk with longitudinal light stripe markings.

GEOGRAPHIC DISTRIBUTION: The three species of *Epactionotus* are endemic to a very narrow area in southern Brazil, each species being restricted to an isolated coastal river drainage: rio Maquiné plus rio Três Forquilhas, rio Mampituba, and rio Araranguá (fig. 1). Those river drainages are each composed of two historically and ecologically distinct portions. Their headwater portions run through deep valleys eroded from basaltic flows dated from approximately 138 to 125 million years ago (Malabarba and Isaia, 1992; Schwarzbold and Schafer, 1984) along the steep eastern slope of the Serra Geral formation. There, the rivers and their tributaries are typical mountain streams with shallow channels, clear water, and rocky bottoms, and drop some 800 m elevation in the 40 km distance from their headwaters to the coastal plain. The lower portions of those rivers, in contrast, traverse the very recent coastal plain, which formed by sedimentary deposition associated with a series of marine transgressions and sea-level fluctuations during the last 6000 years (Malabarba and Isaia, 1992; Schwarzbold and Schafer, 1984). The lower, coastal plain portions of those rivers are usually slower, deeper, and with sandy or muddy bottom. The three species of *Epactionotus* are found only in the rocky upper portions of these rivers, a habitat association shared with various other fish species (see Malabarba and Isaia, 1992, for historical discussion of the fish fauna of the coastal rivers and plains) and likely indicative of a large degree of temporal and geographic isolation.

ETYMOLOGY: Genus *Epactionotus*, from the Greek *epaktios*, meaning upper shore or coast dweller, and *notos*, south, in allusion to the endemic distribution of this genus in the coastal rivers of southern Brazil. Gender masculine.

KEY TO SPECIES OF *EPACTIONOTUS*

1A. Body comparatively wider (width at cleithrum 70.1–76.4% HL) ....*E. bilineatus*, new species
Maquiné and Três Forquilhas
river drainages,
Rio Grande do Sul State, Brazil

1B. Body comparatively narrower (width at cleithrum 60.3–67.2% HL) 2

2A. Longitudinal light stripes on head comparatively broader, extending posteriorly beyond dorsal-fin base, abdomen with a series of granular platelets medially, between the pectoral bridge and anus (fig. 2B) ... . *E. itaimbezinho*, new species
rio Mampituba drainage,
in Rio Grande do Sul and
Santa Catarina States, Brazil

2B. Longitudinal light stripes on head comparatively narrower, not extending posteriorly beyond dorsal fin base, abdomen naked

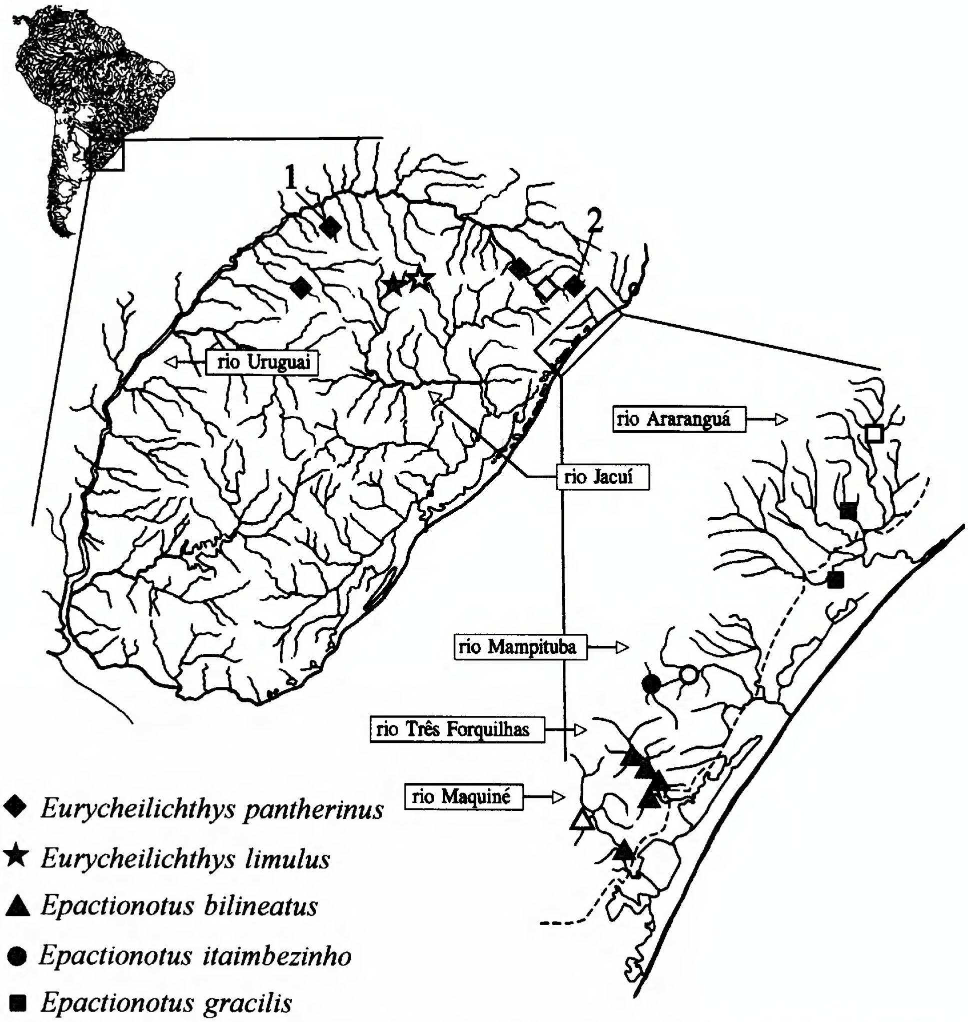
1
2
rio Uruguai
rio Araranguá
rio Jacuí
rio Mampituba
rio Três Forquilhas
rio Maquiné
◆ Eurycheilichthys pantherinus
★ Eurycheilichthys limulus
▲ Epactionotus bilineatus
● Epactionotus itaimbezinho
■ Epactionotus gracilis

Fig. 1. Geographic distribution of *Epactionotus* and *Eurycheilichthys* species in southeastern coastal Brazil. Dashed line in area detailed on the right denotes divide between highlands of the Serra Geral and the coastal lowlands. Open symbols represent type-localities; locations 1 and 2 are collecting localities for *Eurycheilichthys pantherinus* discovered subsequent to its original description.

medially, sometimes with a few embedded platelets between the pelvic fins (fig. 2C) .... *E. gracilis*, new species
rio Ararangua drainage,
Santa Catarina State, Brazil

Epactionotus bilineatus, new species
Figure 3

DIAGNOSIS: *Epactionotus bilineatus* is distinguished from its congeners by comparatively wider snout and body (width at cleithrum 70.1–76.4% HL, versus 60.3–67.2% in other species; fig. 4) and plain dusky color of first rays of pectoral and pelvic fins (individuals occasionally with about three discernible spots), versus first pectoral and pelvic fin rays conspicuously spotted in other two species. Further distinguished from *E. gracilis* by much broader longitudinal light stripe markings on head and predorsal region (fig. 2A), and by shallower prenareal depressions. Further distinguished from *E. itaimbezinho* by naked median abdominal region (fig. 2A, except for presence of few small preanal platelets between pelvic fins), versus median abdominal region plated (fig. 2B, C).

DESCRIPTION: Counts and proportional measurements given in table 1. Dorsal body

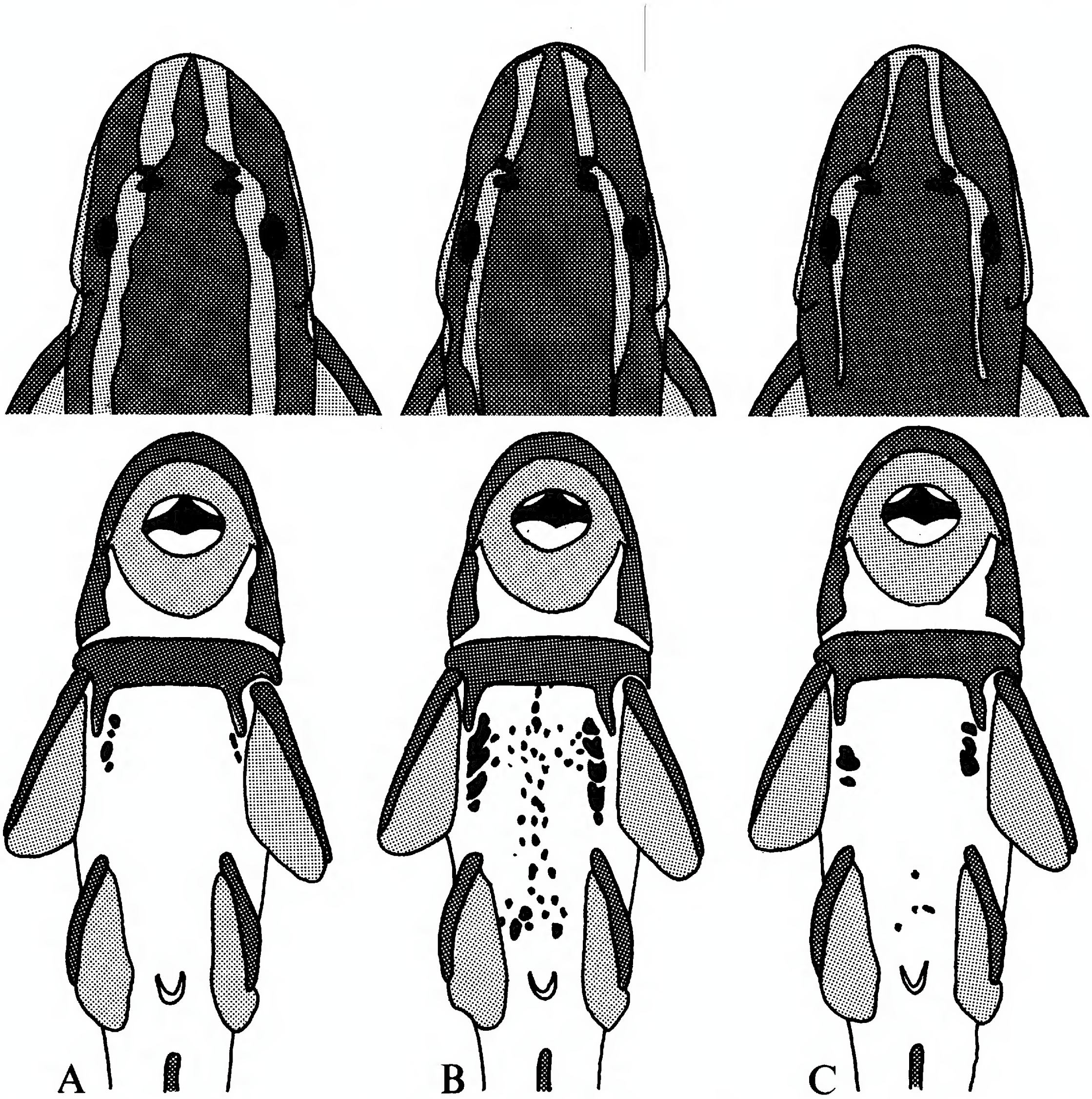

Fig. 2. Schematic illustration of the color pattern of head and predorsal region (top) and arrangement of abdominal platelets (bottom) in *Epactionotus*. **A**, *E. bilineatus*; **B**, *E. itaimbezinho*; **C**, *E. gracilis*.

profile gently arched from snout tip to dorsal-fin origin, sometimes slightly concave at supraoccipital bone. Trunk mostly straight and tapering slightly to caudal-fin base. Trunk and caudal peduncle rounded in cross section, slightly flattened at base of dorsal- and anal fins and compressed caudally. Greatest body depth at dorsal-fin origin. Head and snout broad and rounded anteriorly, body progressively narrowing caudally from cleithrum. Head flat to slightly convex between orbits; superior margin of orbits (dorsolateral margin of frontal and sphenotic bones) not or very slightly elevated. Snout slightly convex anterior to nares. Nostrils at posterior terminus of pair of elongate, very shallow depressions beginning close to snout tip. Eyes small, orbit diameter 12.7–15.8% HL, dorsolaterally placed.

Pectoral fins of moderate size, posterior fin margin straight to slightly rounded; when depressed, reaching to anterior third of pelvic-fin length. Pectoral-fin axillary slit present, with large opening ventral to tip of posterior process of cleithrum (see Pectoral Slit Morphology, below). Pelvic fin short, when de-

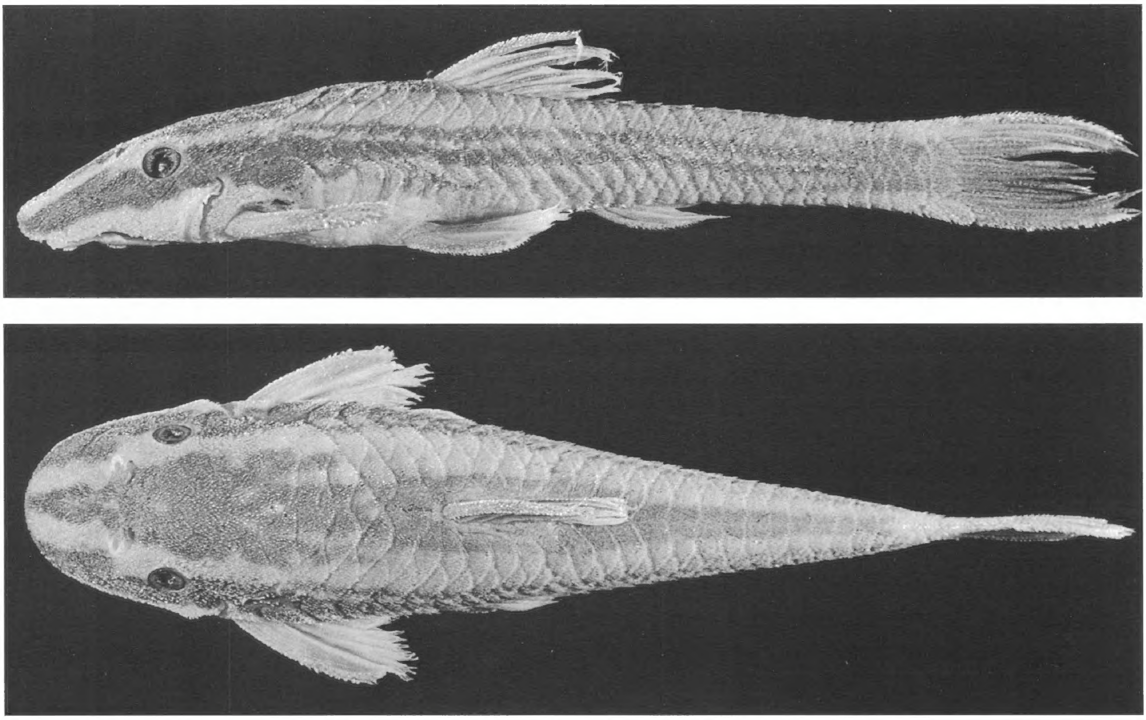

Fig. 3. *Epactionotus bilineatus*, holotype, MCP 20279, 37.9 mm SL female, Brazil: arroio do Ouro between Barra do Ouro and Maquiné, Rio Grande do Sul State.

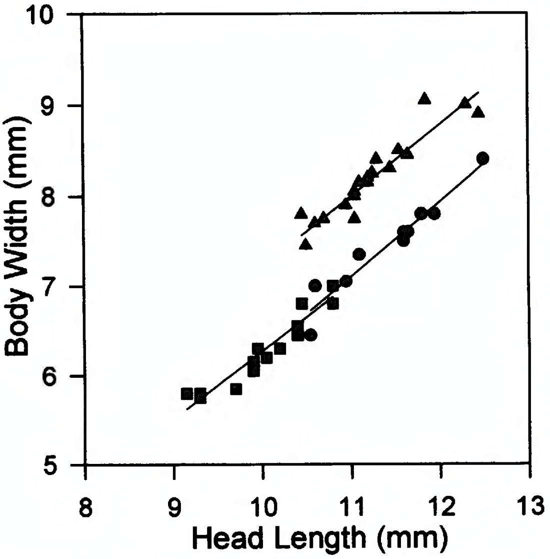

Fig. 4. Bivariate plot of body width at cleithrum versus head length for *Epactionotus* species. Symbols as in fig. 1; lines represent within-species linear regression.

pressed reaching to point midway between anus and anal-fin origin. Males without fleshy flap along posterodorsal margin of thickened first pelvic-fin ray. Dorsal-fin origin at vertical line through end of pelvic-fin base; spinelet present, reduced, dorsal-fin locking mechanism absent. Adipose fin absent.

Body entirely covered by plates except for area around anus, opening of swimbladder capsule posteroventrally to pterotic-supracleithrum, around pectoral- and pelvic-fin insertions, and ventral surface from mouth to anus. Few (2–4) roundish lateral abdominal plates between pectoral- and pelvic-fin insertions, median abdominal area without plates, few small platelets embedded in skin or scattered odontodes sometimes present immediately anterior to anus. Body and head without crests. Coracoids and cleithra completely exposed ventrally, arrector fossae open. Posterior supraoccipital tip with small patch of odontodes slightly raised over those on remainder of head and nape in smaller individuals. Head and body plates covered with odontodes, these larger on ventral face of pelvic- and pectoral-fin spines and on lower surface of snout, anterior to upper lip. Odontodes on head and trunk otherwise of uniform size and distribution, not arranged into conspicuous rows.

Lips roundish and small, papillose, extending posteriorly to middle of canal-bearing lateral cheek plate (Schaefer, 1988: fig. 3C). Maxillary barbel very short. Teeth slender, bifid; major (medial) cusp large, bladelike, and slightly rounded; minor (lateral) cusp minute, pointed. An accessory patch of unicuspid teeth on both premaxilla and dentary bones, not associated with main series of bifid teeth. Accessory teeth located more internally into mouth and attached to dermal bone forming posterior (on premaxilla) and anterior (on dentary) margin of tooth cup, which encloses main series of emergent and pre-emergent bifid teeth. Accessory teeth elongate, sharply pointed, directed posteroventrally (on premaxilla) and anteroventrally (on dentary).

COLOR IN ALCOHOL: Ground color of dorsal surface of head and body light to dark brown (grayish brown in live specimens); yellowish, mostly unpigmented ventrally. Pair of longitudinal light stripes (creamy white in live specimens) on each side of dorsal surface of head and predorsal region. Stripes begin medially on snout tip, pass laterally between nostrils and orbits on each side, and proceed backward to caudal fin, becoming fainter posterior to dorsal fin. Two additional, narrower longitudinal light stripes on each side of predorsal area, posterior to supraoccipital bone. Stripes usually merging with lateral, wider stripe at dorsal-fin base. Lateral-line pores relatively unpigmented, forming very thin longitudinal stripe in middle of dark sides of body. Few irregular lighter marks on predorsal area sometimes present. Lateral margins of head and trunk light yellowish (creamy white in live specimens), below line from upper lip, passing through posterior tip of opercular bone and tip of posterior process of cleithrum. First thickened rays of dorsal, pectoral, and pelvic fins mostly plain dusky (sometimes with chromatophores arranged in few discernible blotches). Branched rays in these fins with similar color pattern. Dorsal and ventral borders of pectoral-fin slit (see Pectoral Slit Morphology, below) densely pigmented with brownish black chromatophores. Concentration of black chromatophores on ventral side of branched pectoral-fin ray origins. Anal fin mostly unpigmented. Ventral lobe of caudal-fin base dark brown; dorsal lobe lighter. Few dots on leading upper caudal-fin ray and upper branched rays.

DISTRIBUTION: *Epactionotus bilineatus* is so far known only from the rio Maquiné, the rio Três Forquilhas and its tributaries in Rio Grande do Sul State, southern Brazil (fig. 1). These rivers empty into the coastal lagoons of northeastern Rio Grande do Sul, forming an isolated hydrographic drainage.

ECOLOGY: All habitats where this species has been captured are shallow, small rivers or creeks with bottom composed of rocks and loose stones and slow to moderate water current. Water is usually very clear and cold in the austral winter. Grass or other vegetation is always present on the stream margins. The fishes are usually found on leaves and stalks of marginal vegetation, frequently adhering by means of their pelvic fins.

ETYMOLOGY: Specific epithet *bilineatus* from the Latin *bi*, two, double and *lineatus*, with a line or stripe, in allusion to the conspicuous pattern of light stripes on dorsum of head and body.

MATERIAL EXAMINED: Brazil, Rio Grande do Sul State: 48 specimens, 15.6–39.9 mm SL.

Holotype: MCP 20279 (37.9 mm, female) mouth of arroio do Ouro, which flows into rio Maquiné, between Barra do Ouro and Maquiné, 29°35′S, 50°17′W, A. Kindel, 19 Nov. 1990.

Paratypes: ANSP 168961 (4) rio Maquiné at Maquiné, 29°40′S, 50°12′W, R. E. Reis, C. A. S. Lucena and L. R. Malabarba, 25 May 1986; ANSP 168970 (4) rio Três Forquilhas at Porto Alagio, Torres, R. E. Reis, C. A. S. Lucena and L. R. Malabarba, 25 May 1986; MCN 11099 (4) and MCN 11104 (4) Rio Três Forquilhas, Terra de Areia, K. M. Grosser and R. C. Cordeiro, 31 July 1990; MCP 13610 (2) rio Maquiné, near the town of Maquiné, 29°40′S, 50°12′W, R. E. Reis, S. O.

TABLE 1

Morphometric and Meristic Data for *Epactionotus bilineatus*

Corresponding measurements of Boeseman (1968) indicated by letters in parentheses; SD designates standard deviation.

Character	n	Low	High	Mean	SD
Standard length (A) (mm)	21	30.5	39.3	34.0	2.325
PERCENT OF STANDARD LENGTH					
Predorsal length (D)	21	44.7	49.0	47.1	1.220
Head length (E)	**21**	**31.3**	**35.6**	**33.1**	**1.195**
Dorsal-fin spine length (K)	20	19.1	23.7	21.3	1.246
Dorsal-fin base length (L)	21	10.2	14.8	12.5	0.994
Trunk length (N)	21	15.7	19.7	17.3	1.092
Pectoral-fin spine length (O)	21	18.9	23.5	21.1	1.157
Abdominal length (P)	21	17.9	20.8	19.5	0.699
Caudal peduncle length (R)	21	30.8	34.3	32.2	1.017
Caudal peduncle depth (S)	21	9.1	11.0	10.0	0.594
PERCENT OF HEAD LENGTH					
Head depth (G)	21	39.7	45.2	42.7	1.433
Snout length (H)	21	53.0	57.1	55.3	1.079
Horizontal eye diameter (I)	21	12.7	15.8	14.1	0.702
Least interorbital width (J)	21	37.1	42.0	39.8	1.139
Cleithral width (F)	21	70.1	76.4	72.8	1.426
COUNTS					
Left lateral plates	21	26	29	28.0	0.894
Right lateral plates	21	27	29	28.0	0.775
Predorsal plates	21	3	5	3.7	0.658
Left premaxillary teeth	21	13	20	17.3	1.983
Right premaxillary teeth	20	15	20	17.0	1.669
Left dentary teeth	20	13	19	16.5	1.960
Right dentary teeth	21	13	20	17.0	1.817
Dorsal-fin branched rays	21	6	7	6.9	0.359
Pectoral-fin branched rays	21	6	6	6.0	0.000
Pelvic-fin branched rays	21	5	5	5.0	0.000
Anal-fin branched rays	21	5	5	5.0	0.000
Caudal-fin branched rays	21	12	14	13.8	0.512

Kullander, L. R. Malabarba and J. F. P. Silva, 1 Oct. 1989; MCP 14151 (1) rio Três Forquilhas, ca. 100 m before bridge on road from Três Forquilhas to Itati, 29°30′S, 50°05′30″W, Terra de Areia, C. Weber, Z. M. S. Lucena, P. V. Azevedo and S. Muller, 12 Dec. 1989; MCP 14806 (4 + 1cs) rio Três Pinheiros, tributary of rio Três Forquilhas, 8 km NW from highway BR-101 in direction to Itati, 29°32′S, 50°06′W, Terra de Areia, R. E. Reis, N.A. Menezes, E.H.L. Pereira and A. A. Andreata, 15 Jan. 1991; MCP 20280 (17 + 2cs) collected with the holotype; MZUSP 52460 (4) Rio Três Forquilhas at Itati, 29°28′S, 50°06′W, Terra de Areia, A. Kindel and E. A. Isaia, 30 March 1990.

Epactionotus itaimbezinho, new species

Figure 5

DIAGNOSIS: *Epactionotus itaimbezinho* is distinguished from its congeners by possession of series of scattered abdominal platelets, individual platelets sometimes covered by skin, between pectoral girdle and anus (fig. 2B). Further distinguished from *E. bili-*

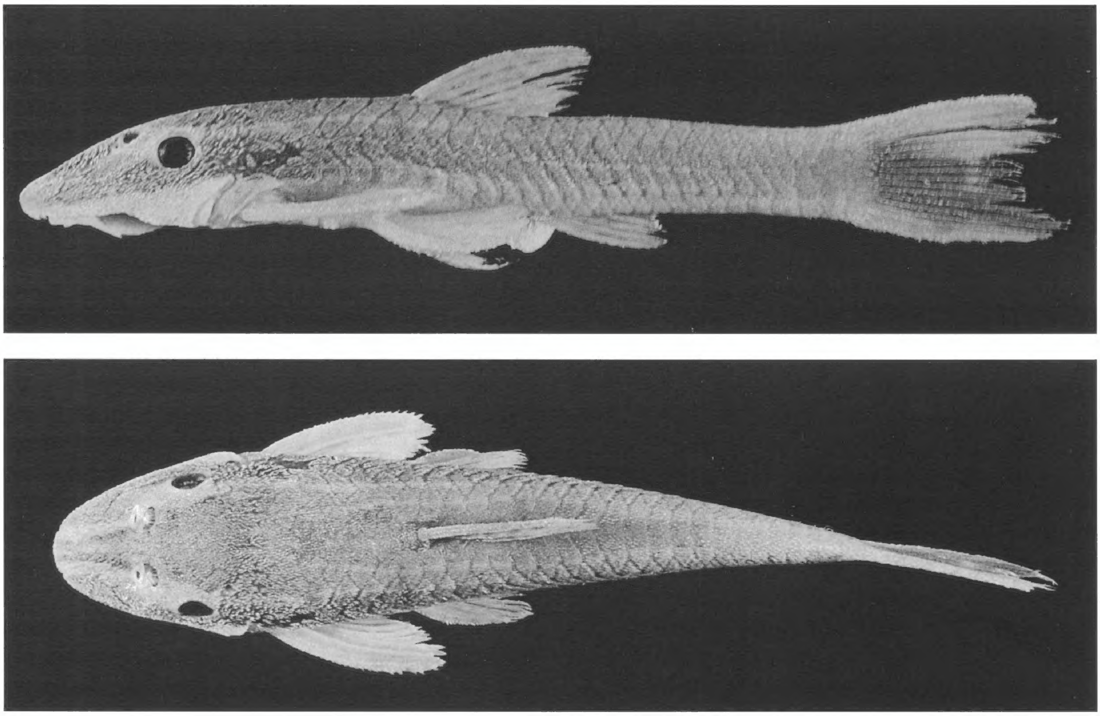

Fig. 5. *Epactionotus itaimbezinho*, holotype, MCP 20281, 35.1 mm SL female, Brazil: rio Canoas in Praia Grande, Santa Catarina State.

neatus in having first rays of pectoral and pelvic fins spotted, versus fin rays plain and dusky, and by its comparatively narrower body (width at cleithrum 61.1–67.2% HL, versus 70.1–76.4% in other species; fig. 4). Further distinguished from *E. gracilis* by broader longitudinal light stripe markings on head and predorsal region (fig. 2B).

DESCRIPTION: Counts and proportional measurements given in table 2. Dorsal body profile gently arched from snout tip to dorsal-fin origin, sometimes slightly concave at supraoccipital bone. Trunk slightly concave at dorsal-fin base and mostly straight and tapering slightly to caudal-fin base. Trunk and caudal peduncle rounded in cross section, slightly flattened at base of dorsal and anal fins and compressed caudally. Greatest body depth at dorsal-fin origin. Snout moderately broad and rounded anteriorly, body progressively narrowing caudally from cleithrum. Head slightly convex between orbits; superior margin of orbits (dorsolateral margin of frontal and sphenotic bones) slightly elevated. Snout slightly convex anterior to nares. Nostrils at posterior terminus of pair of elongate depressions beginning close to snout tip. Eyes small, orbit diameter 12.7–14.4% HL, dorsolaterally placed.

Pectoral fins of moderate size, posterior fin margin slightly rounded; when depressed, reaching to anterior third to half of pelvic fin length. Pectoral-fin axillary slit present, with large opening ventral to tip of posterior process of cleithral bone (see Pectoral Slit Morphology, below). Pelvic fin short, when depressed reaching point midway between anus and anal-fin origin. Males without fleshy flap along posterodorsal margin of thickened first pelvic-fin ray. Dorsal-fin origin at vertical line through end of pelvic-fin base; spinelet present, reduced, dorsal-fin locking mechanism absent. Adipose fin absent.

Body entirely covered by plates except for area around anus, opening of swimbladder capsule posteroventrally to pterotic-supracleithrum, around pectoral- and pelvic-fin insertions, and most of ventral surface from mouth to anus. Few (2–6) elongate lateral abdominal plates between pectoral- and pelvic-fin insertions, small median platelets arranged in one or more irregular rows between cleithrum and anus (fig. 2B). Body and head without crests. Coracoids and cleithra completely exposed ventrally, arrector fossae open. Posterior supraoccipital tip with small patch of odontodes slightly raised over those on remainder of head and nape in smaller individuals. Head and body plates covered with odontodes, these larger on ventral face of pelvic- and pectoral-fin spines and on lower surface of snout, anterior to upper lip. Odontodes on head and trunk otherwise of uniform size and distribution, not arranged into conspicuous rows.

Lips roundish and small, papillose, extending posteriorly to middle of canal-bearing cheek plate (Schaefer, 1988: fig. 3C). Maxillary barbel short. Teeth slender, bifid; major (medial) cusp large, bladelike and slightly rounded; minor (lateral) cusp minute, pointed. An accessory patch of unicuspid teeth on both premaxilla and dentary bones, not associated with main series of bifid teeth. Accessory teeth located more internally and attached to dermal bone forming posterior (on premaxilla) and anterior (on dentary) margin of tooth cup, which encloses main series of emergent and pre-emergent bifid teeth. Accessory teeth elongate, sharply pointed, directed posteroventrally (on premaxilla) and anteroventrally (on dentary).

COLOR IN ALCOHOL: Ground color of dorsal surface of head and body light to dark brown (grayish brown in living specimens); yellowish, mostly unpigmented ventrally. Longitudinal light stripe (creamy white in live specimens) on each side of dorsum, narrowing posterior to pterotic-supracleithral bone. Stripes begin medially on snout tip, pass laterally between nostrils and orbits on each side, and proceed caudad to caudal fin, becomming much fainter posterior to dorsal fin. Two additional, narrower longitudinal light stripes on each side of predorsal area, posterior to supraoccipital bone. Stripes usually not merging with outer, more lateral stripe. Lateral-line pores sometimes lighter, forming very thin longitudinal stripe along middle and within dark sides of body. Lateral margins of head and trunk light yellowish (creamy white in live specimens), below line from upper lip, passing through posterior tip of opercular bone and tip of posterior process of cleithrum. Very thin lighter stripe sometimes present on midline of snout, from tip to between nostrils. Dorsal-fin spine and branched rays usually with series of dark spots. First thickened rays of pectoral and pelvic fins mostly plain dusky (sometimes with chromatophores arranged in few discernible blotches). Branched rays of paired fins with series of spots. Dorsal and ventral borders of pectoral-fin axillary slit (see Pectoral Slit Morphology, below) with some brownish black chromatophores. Small concentration of black chromatophores on ventral side of branched pectoral-fin ray origins. Anal fin mostly unpigmented. Ventral lobe of caudal-fin base dark brown; dorsal lobe lighter. Few spots on leading dorsal caudal-fin ray and dorsal branched rays.

DISTRIBUTION: *Epactionotus itaimbezinho* is so far known only from two localities in the upper reaches of the rio Mampituba drainage, an isolated coastal stream situated along the border between Rio Grande do Sul and Santa Catarina States, southern Brazil (fig. 1).

ECOLOGY: The habitat at the type locality is a small, shallow river with rocks, loose stones, and gravel on the bottom and transparent, slow-flowing water. Moderate amounts of grass and other vegetation were present on the margins. During floods, the rio Canoas, a tributary of the rio Mampituba, is reported to reach high levels and have very strong currents.

ETYMOLOGY: Specific epithet *itaimbezinho,* after the magnificent canyon Itaimbezinho, which is located near the type locality and whose river is part of the headwaters of the rio Mampituba. A noun in apposition.

MATERIAL EXAMINED: Brazil, Santa Catarina State: 21 specimens, 28.4–38.3 mm SL.

Holotype: MCP 20281 (35.1 mm, female) rio Canoas, tributary of rio Mampituba, ca. 8 km from Praia Grande in the direction of Mãe dos Homens, 29°14′S, 50°01′W, Praia Grande, R. E. Reis, N. A. Menezes, E. H. L. Pereira and A. A. Andreata, 16 Jan. 1991.

Paratypes: ANSP 168954 (5) rio Faxinalzinho at Mãe dos Homens, 29°15′S, 50°06′W, Praia Grande, R. E. Reis, C. A. S. Lucena and L. R. Malabarba, 3 May 1985; MCP 14708 (12 + 3cs) collected with the holotype.

TABLE 2
Morphometric and Meristic Data for *Epactionotus itaimbezinho*
Corresponding measurements of Boeseman (1968) indicated by letters in parentheses; SD designates standard deviation.

Character	n	Low	High	Mean	SD
Standard length (A) (mm)	10	28.4	38.3	33.0	2.694
PERCENT OF STANDARD LENGTH					
Predorsal length (D)	10	47.3	52.1	48.6	1.325
Head length (E)	**10**	**32.6**	**37.1**	**34.7**	**1.194**
Dorsal-fin spine length (K)	10	19.9	23.8	21.5	1.189
Dorsal-fin base length (L)	10	10.4	12.9	11.5	0.780
Trunk length (N)	10	14.2	19.8	16.9	1.850
Pectoral-fin spine length (O)	10	18.4	21.8	20.2	1.018
Abdominal length (P)	10	18.1	21.0	19.5	0.981
Caudal peduncle length (R)	10	29.7	32.4	31.4	0.972
Caudal peduncle depth (S)	10	10.0	11.5	10.7	0.580
PERCENT OF HEAD LENGTH					
Head depth (G)	10	37.9	42.8	40.7	1.418
Snout length (H)	10	53.6	56.5	54.9	0.877
Horizontal eye diameter (I)	10	12.7	14.4	13.5	0.529
Least interorbital diameter (J)	10	37.0	41.0	39.1	1.265
Cleithral width (F)	10	61.1	67.2	65.2	1.637
COUNTS					
Left lateral plates	10	27	29	27.4	0.699
Right lateral plates	10	27	29	27.6	0.699
Predorsal plates	10	4	4	4.0	0.000
Left premaxillary teeth	10	15	19	17.4	1.350
Right premaxillary teeth	10	14	20	17.3	1.636
Left dentary teeth	10	15	19	17.1	1.663
Right dentary teeth	9	15	19	17.2	1.481
Dorsal-fin branched rays	10	7	8	7.1	0.316
Pectoral-fin branched rays	10	6	6	6.0	0.000
Pelvic-fin branched rays	10	5	5	5.0	0.000
Anal-fin branched rays	10	5	5	5.0	0.000
Caudal-fin branched rays	10	14	14	14.0	0.000

***Epactionotus gracilis*, new species**
Figure 6

DIAGNOSIS: *Epactionotus gracilis* is distinguished from its congeners by comparatively narrower longitudinal light stripes on head and predorsal region (fig. 2C). Further distinguished from *E. bilineatus* by narrower body (width at cleithrum 60.3–65.1% HL, versus 70.1–76.4% in other species; fig. 4), by first rays of the pectoral and pelvic fins spotted (mostly plain dusky in *E. bilineatus*), and by deeper depressions of pre-nareal area. Further distinguished from *E. itaimbezinho* by absence of median abdominal platelets, except for few platelets between pelvic fins covered by skin (fig. 2C).

DESCRIPTION: Counts and proportional measurements given in table 3. Dorsal body profile gently arched from snout tip to supraoccipital bone, sometimes slightly concave at supraoccipital bone; slightly convex to straight from supraoccipital to dorsal-fin origin. Trunk mostly straight and tapering slightly to caudal-fin base. Trunk and caudal peduncle rounded in cross section, slightly flattened at base of dorsal- and anal fins and

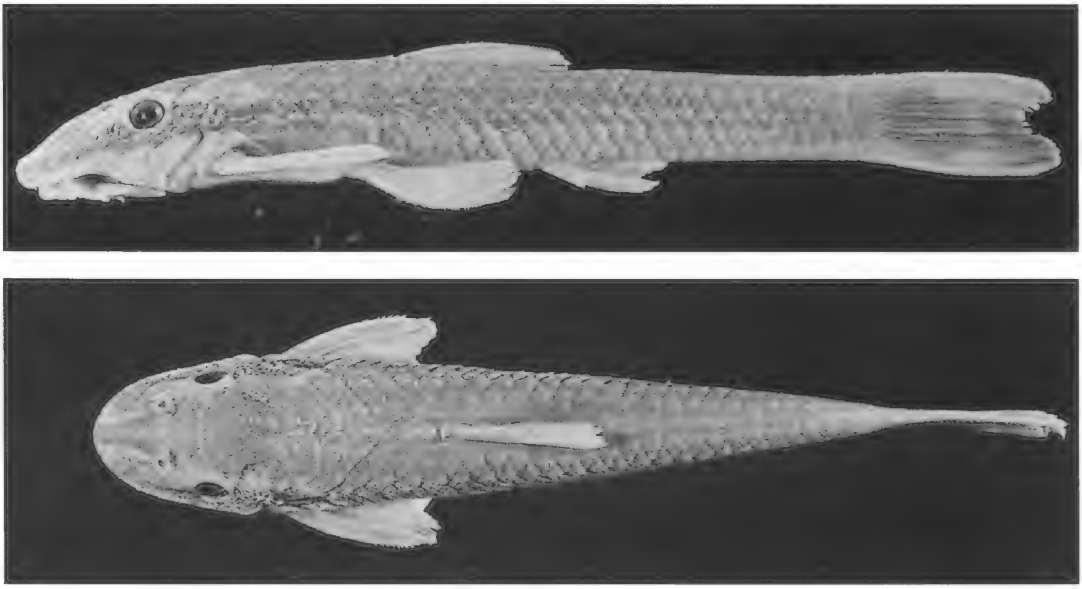

Fig. 6. *Epactionotus gracilis*, holotype, MCP 20282, 34.2 mm SL female, Brazil: rio Jordão at Jordão Alto, Nova Veneza, Santa Catarina State.

compressed caudally. Greatest body depth at dorsal-fin origin. Head and snout narrow and rounded anteriorly, body progressively narrowing caudally from cleithrum. Head flat to slightly convex between orbits; superior margin of orbits (dorsolateral margin of frontal and sphenotic bones) not or very slightly elevated. Snout slightly convex anterior to nares. Nostrils at posterior terminus of pair of elongate depressions beginning close to snout tip. Eyes small, orbit diameter 13.6–15.4% HL, dorsolaterally placed.

Pectoral fins of moderate size, posterior fin margin slightly rounded; when depressed, reaching to third to half of pelvic fin length. Pectoral-fin axillary slit present, with large opening ventral to tip of posterior process of cleithral bone (see Pectoral Slit Morphology, below). Pelvic fin short, when depressed reaching to point midway between anus and anal-fin origin. Males without fleshy flap along posterodorsal margin of thickened first pelvic-fin ray. Dorsal-fin origin at vertical line behind end of pelvic-fin base; spinelet present, reduced, dorsal-fin locking mechanism absent. Adipose fin absent.

Body entirely covered by plates except for area around anus, opening of swimbladder capsule posteroventrally to pterotic-supracleithrum, around pectoral- and pelvic-fin insertions, and ventral surface from mouth to anus. Few (2–4) elongate lateral abdominal plates between pectoral- and pelvic-fin insertions, median abdominal area without plates or with few small platelets embedded in skin or scattered odontodes sometimes present immediately anterior to anus (fig. 2C). Body and head without crests. Coracoids and cleithra completely exposed ventrally, arrector fossae open. Posterior supraoccipital tip with small patch of odontodes slightly raised over those on remainder of head and nape in smaller individuals. Head and body plates covered with odontodes, these larger on ventral face of pelvic- and pectoral-fin spines and on ventral surface of snout, anterior to upper lip. Odontodes on head and trunk otherwise of uniform size and distribution, not arranged into conspicuous rows.

Lips roundish and small, papillose, extending posteriorly to middle of canal-bearing lateral cheek plate (Schaefer, 1988: fig. 3C). Maxillary barbel short. Teeth slender, bifid; major (medial) cusp large, bladelike and slightly rounded; minor (lateral) cusp minute, pointed. An accessory patch of unicuspid teeth on both premaxilla and dentary bones, not associated with main series of bifid teeth. Accessory teeth located more internally into mouth and attached to dermal

TABLE 3

Morphometric and Meristic Data for *Epactionotus gracilis*

Corresponding measurements of Boeseman (1968) indicated by letters in parentheses; SD designates standard deviation.

Character	n	Low	High	Mean	SD
Standard length (A) (mm)	15	26.0	34.1	29.4	2.542
PERCENT OF STANDARD LENGTH					
Predorsal length (D)	15	48.0	51.1	49.4	1.056
Head length (E)	**15**	**31.7**	**35.9**	**34.3**	**1.395**
Dorsal-fin spine length (K)	15	18.4	21.6	20.5	0.967
Dorsal-fin base length (L)	15	8.9	11.9	10.5	0.910
Trunk length (N)	15	13.9	17.3	15.6	0.964
Pectoral-fin spine length (O)	15	17.0	21.0	19.6	1.338
Abdominal length (P)	15	18.8	22.3	20.1	0.895
Caudal peduncle length (R)	15	29.3	33.9	32.0	1.271
Caudal pecuncle depth (S)	15	10.0	11.5	10.8	0.431
PERCENT OF HEAD LENGTH					
Head depth (G)	15	39.2	42.8	40.9	1.059
Snout length (H)	15	51.2	55.4	53.1	0.945
Horizontal eye diameter (I)	15	13.6	15.4	14.4	0.564
Least interorbital width (J)	15	37.6	40.3	38.7	0.863
Cleithral width (F)	15	60.3	65.1	62.7	1.427
COUNTS					
Left lateral plates	15	27	30	28.6	0.910
Right lateral plates	15	27	31	29.1	1.033
Predorsal plates	15	4	4	4.0	0.000
Left premaxillary teeth	11	13	17	14.6	1.286
Right premaxillary teeth	15	13	16	14.4	1.056
Left dentary teeth	15	13	15	13.9	0.799
Right dentary teeth	14	13	16	14.0	1.038
Dorsal-fin branched rays	15	6	7	6.9	0.258
Pectoral-fin branched rays	15	6	6	6.0	0.000
Pelvic-fin branched rays	15	5	5	5.0	0.000
Anal-fin branched rays	15	5	5	5.0	0.000
Caudal-fin branched rays	15	14	14	14.0	0.000

bone forming posterior (on premaxilla) and anterior (on dentary) margin of tooth cup, which encloses main series of emergent and pre-emergent bifid teeth. Accessory teeth elongate, sharply pointed, directed posteroventrally (on premaxilla) and anteroventrally (on dentary).

COLOR IN ALCOHOL: Ground color of dorsal surface of head and body light to dark brown (grayish brown in live specimens); yellowish, mostly unpigmented ventrally. Pair of longitudinal light stripes on each side of dorsal surface of head and predorsal region. Stripes begin medially on snout tip, pass laterally between nostrils and orbits on each side, and proceed backward, narrowing after pterotic-supracleithrum, terminating at or near dorsal-fin base. Lateral margins of head and trunk, below line from upper lip to posterior tip of opercular bone and tip of posterior process of cleithrum, lighter than dorsal portions of head, but with some dark blotches of irregular size and shape. First thickened rays of dorsal, pectoral, and pelvic fins with chromatophores arranged in series of small dots. Branched rays in these fins with similar color pattern. Dorsal and ventral borders of pectoral-fin slit (see Pectoral Slit Morphology, below) densely pigmented with brownish black chromatophores. Concentration of black chromatophores on ventral side of branched pectoral-fin ray origins. Anal fin mostly unpigmented. Ventral lobe of caudal-fin base dark brown; dorsal lobe lighter. Few dots on leading dorsal caudal-fin ray and dorsal branched rays.

DISTRIBUTION: *Epactionotus gracilis* is known from three localities in the upper reaches of rio Araranguá, an isolated coastal drainage in southern Santa Catarina State, Brazil.

ECOLOGY: The habitats at the collecting localities are small, shallow rivers with very clear, transparent water and slow to moderate current. The bottom comprises rocks, loose stones, gravel, sand, and mud. Water can be very cold in the austral winter and air temperature at the time of collection of the holotype was below 0°C.

ETYMOLOGY: Specific epithet is from the Latin *gracilis*, meaning slender and gracile, in reference to the generally slender and narrow body form.

MATERIAL EXAMINED: Brazil, Santa Catarina State: 52 specimens, 23.2–38.9 mm SL.

Holotype: MCP 20282 (34.2 mm, female) rio Jordão at Jordão Alto, 28°36'S, 49° 29'W, Nova Veneza, R. E. Reis, L. R. Malabarba and C. A. S. Lucena, 7 June 1985.

Paratypes: ANSP 168968 (20) and MCP 11615 (17 + 2 cs) collected with the holotype; MCP 19193 (2) rio do Cedro on road from Meleiro to Forquilhinha, rio Araranguá drainage, 28°48'S, 49°34'W, E. H. L. Pereira, J. F. Pezzi da Silva, and A. R. Cardoso, 14 June 1996; USNM 285878 (10) arroio Ararangua Ermo, Ararangua, 28°56'S, 46°29'W, R. E. Reis, L. R. Malabarba and C. A. S. Lucena, 6 June 1985.

Eurycheilichthys limulus, new species

Figure 7

DIAGNOSIS: No autapomorphies were found for *Eurycheilichthys limulus*. The new species shares with its sole congener, *E. pantherinus*, the derived presence of seven branched pectoral-fin rays, but lacks other derived features diagnostic of the latter species, such as reduction of the accessory ceratobranchial flange and absence of filamentous gill rakers (Reis and Schaefer, 1992). The new species can be distinguished from *E. pantherinus* by its narrow body (width at cleithrum 23.6–27.7% SL, versus 27.5–31.8% SL) and by the head and dorsal trunk with series of longitudinal light stripe markings, versus scattered dark blotches. Although longitudinal light stripe markings on head and body are more restricted in distribution among hypoptopomatine genera than either dusky or spotted pigmentation, we have little evidence upon which to hypothesize homologies for these pigmentation patterns among species of *Eurycheilichthys* and, therefore, do not propose that presence of either pigmentation pattern can be regarded as diagnostic for the individual species.

DESCRIPTION: Counts and proportional measurements given in table 4. Dorsal body profile gently arched from snout tip to dorsal-fin origin, supraoccipital bone more salient in larger individuals. Trunk generally straight and tapering slightly to caudal-fin base. Trunk and caudal peduncle rounded in cross section, slightly flattened at and behind base of dorsal and anal fins and compressed caudally. Greatest body depth at dorsal-fin origin. Head and snout broad and rounded anteriorly, body progressively narrowing caudally from cleithrum. Head flat to slightly convex between orbits; superior margin of orbits (dorsolateral margin of frontal and sphenotic bones) slightly elevated. Snout slightly convex anterior to nares. Nostrils at posterior terminus of pair of elongate, shallow depressions located close to snout tip. Eyes small, orbit diameter 10.2–13.2% HL, dorsolaterally placed.

Pectoral fins of moderate size, posterior fin-margin straight to slightly rounded; when depressed, reaching to middle of pelvic fin. Pectoral-fin axillary slit present, with large opening ventral to tip of posterior process of cleithrum (see Pectoral Slit Morphology, below). Pelvic fin of females short, when depressed reaching to point midway between anus and anal-fin origin. Thickened first pelvic-fin ray of males longer, sometimes reaching to anal-fin origin. Males with well-developed fleshy flap along posterodorsal margin of thickened first pelvic-fin ray. Dorsal-

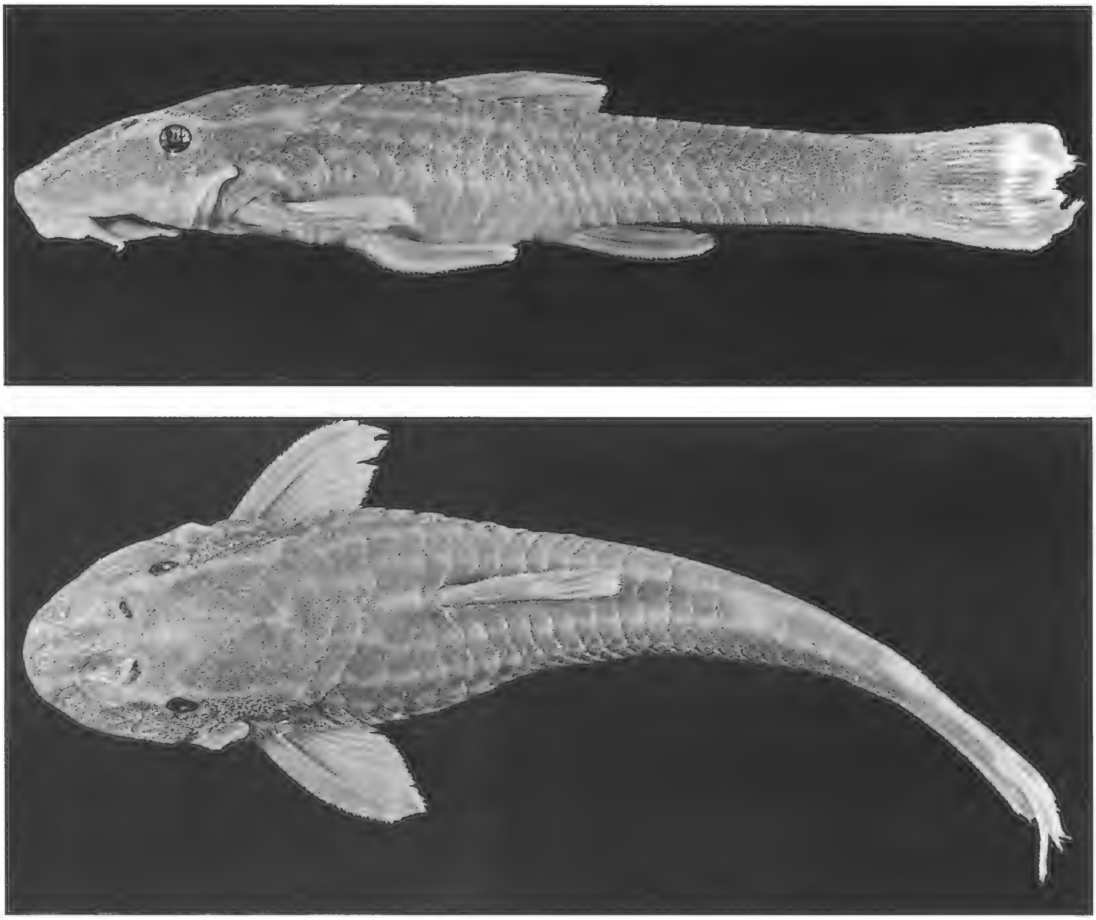

Fig. 7. *Euricheilichthys limulus*, holotype, MCP 20283, 43.6 mm SL female, Brazil: rio Jacuí, Passo Fundo, Rio Grande do Sul State.

fin origin at vertical line through end of pelvic-fin base; spinelet present, reduced, dorsal-fin locking mechanism absent. Adipose fin absent.

Body entirely covered by plates except for area around anus, opening of swimbladder capsule posteroventrally to pterotic-supracleithrum, around pectoral- and pelvic-fin insertions, and ventral surface of head around lips. Body and head without crests. Coracoids and cleithra exposed laterally, covered medially by skin and few isolated platelets, arrector fossae open. Posterior supraoccipital tip with small patch of odontodes slightly raised over those on remainder of head and nape, especially in smaller individuals. Head and body plates covered with odontodes, these larger on ventral face of pelvic- and pectoral-fin spines. Odontodes on head and trunk otherwise of uniform size and distribution, not arranged in conspicuous rows.

Lips roundish and wide, papillose, extending posteriorly to end of canal-bearing lateral cheek plate (Schaefer, 1988: fig. 3C) or to point between posterior margin of canal-bearing lateral cheek plate and pectoral girdle. Maxillary barbel short. Teeth slender, bifid; major (medial) cusp large, bladelike, and slightly rounded; minor (lateral) cusp minute, pointed. An accessory patch of unicuspid teeth on both premaxilla and dentary bones, not associated with main series of bifid teeth. Accessory teeth located more internally into mouth and attached to dermal bone forming posterior (on premaxilla) and anterior (on dentary) margin of tooth cup, which encloses main series of emergent and pre-emergent bifid teeth. Accessory teeth elongate, sharply

TABLE 4
Morphometric and Meristic Data for *Eurycheilichthys limulus*
Corresponding measurements of Boeseman (1968) indicated by letters in parentheses; SD designates standard deviation.

Character	n	Low	High	Mean	SD
Standard length (A) (mm)	26	28.5	47.9	37.6	6.013
PERCENT OF STANDARD LENGTH					
Predorsal length (D)	26	45.2	50.9	47.6	1.593
Head length (E)	**26**	**31.4**	**37.8**	**34.3**	**1.611**
Dorsal-fin spine length (K)	26	19.0	23.5	20.9	1.178
Dorsal-fin base length (L)	26	9.3	11.7	10.2	0.643
Trunk length (N)	26	12.7	16.5	14.6	1.135
Pectoral-fin spine length (O)	26	17.7	24.6	20.4	1.401
Abdominal length (P)	25	19.5	23.3	21.2	0.935
Caudal peduncle length (R)	25	31.0	36.3	33.5	1.457
Caudal peduncle depth (S)	26	9.2	11.5	10.3	0.505
PERCENT OF HEAD LENGTH					
Head depth (G)	26	42.0	52.2	46.9	2.396
Snout length (H)	26	51.8	57.6	54.5	1.616
Horizontal eye diameter (I)	26	10.2	13.2	11.6	0.678
Least interorbital diameter (J)	26	33.5	40.7	37.1	2.107
Cleithral width (F)	26	67.0	79.3	73.0	3.502
COUNTS					
Left lateral plates	26	27	29	27.8	0.613
Right lateral plates	26	26	29	27.7	0.618
Predorsal plates	26	3	4	3.3	0.485
Left premaxillary teeth	24	13	20	16.6	2.060
Right premaxillary teeth	25	13	19	16.2	1.607
Left dentary teeth	24	12	19	14.4	1.613
Right dentary teeth	24	12	17	14.0	1.429
Dorsal-fin branched rays	26	6	7	7.0	0.196
Pectoral-fin branched rays	26	6	7	6.8	0.402
Pelvic-fin branched rays	26	5	5	5.0	0.000
Anal-fin branched rays	25	5	5	5.0	0.000
Caudal-fin branched rays	26	12	14	13.9	0.392

pointed, directed posteroventrally (on premaxilla) and anteroventrally (on dentary).

COLOR IN ALCOHOL: Ground color of dorsal surface of head and body light to dark brown (grayish brown in live specimens); yellowish, mostly unpigmented ventrally. Longitudinal light stripe on each side of dorsum. Stripes begin on snout tip, cross between nostrils and orbits on each side, becoming faint posterior to dorsal fin. Two other, narrower longitudinal light stripes begin on each side of predorsal area posterior to supraoccipital bone. Lateral-line pores relatively unpigmented, forming very thin longitudinal stripe along middle of dark sides of body. Hypertrophied odontodes on tip of supraoccipital bone, lighter than background. Lateral margins of head and trunk yellowish below line from upper lip, passing through posterior tip of opercular bone and tip of posterior process of cleithrum. First thickened rays of dorsal, pectoral, pelvic, and anal fins mostly plain dusky, sometimes with chromatophores arranged in few discernible blotches. Branched rays in these fins with similar color pattern. Anal fin mostly unpigmented. Caudal fin mostly dark brown, with light vertical band on middle of distal half; dorsal lobe lighter.

DISTRIBUTION: *Eurycheilichthys limulus* is presently known from two localities in the upper reaches of the rio Jacuí drainage (fig. 1), Rio Grande do Sul State, Brazil.

ECOLOGY: The habitat at the type locality is a small river about 3–5 m wide with moderate water current, bottom comprising some rocks but mostly sand and a large amount of marginal vegetation. The fishes were taken from leaves and stalks.

ETYMOLOGY: Specific epithet from the Latin *limula*, diminutive of *lima*, meaning scraper or grinder, in allusion to the patches of accessory teeth on both dentary and premaxilla.

MATERIAL EXAMINED: Brazil, Rio Grande do Sul State: 78 specimens, 28.5–47.9 mm SL.

Holotype: MCP 20283 (43.6 mm, female) rio Jacuí on road RS-010, between Marau and Passo Fundo, 28°18′S, 52°18′W, R. E. Reis, 19 March 1981.

Paratypes: ANSP 168965 (23 + 5 cs) and MCP 13086 (46 + 2 cs) collected with the holotype; MCP 14528 (1) rio Umbu at Victor Graeff, 28°35′S, 52°45′W, A. Winekler, 8 Sept. 1988.

DISCUSSION

SPECIES COMPARISONS: *Epactionotus bilineatus* is easily distinguished from its congeners on the basis of the wider body between the cleithra (70.1–76.4% HL, versus 60.3–67.2% HL). *Epactionotus gracilis* and *E. itaimbezinho* can be differentiated from one another by the posterior extent and width of the light stripes on the dorsum of the head and body, which are thinner and do not extend posteriorly beyond the dorsal-fin base in *E. gracilis*, and by the distribution of platelets on the abdomen. *Epactionotus itaimbezinho* has a median series of granular platelets between the pectoral bridge and the anus, whereas *E. gracilis* has the abdomen naked medially, sometimes with a few platelets covered by skin between the pelvic fins (fig. 2).

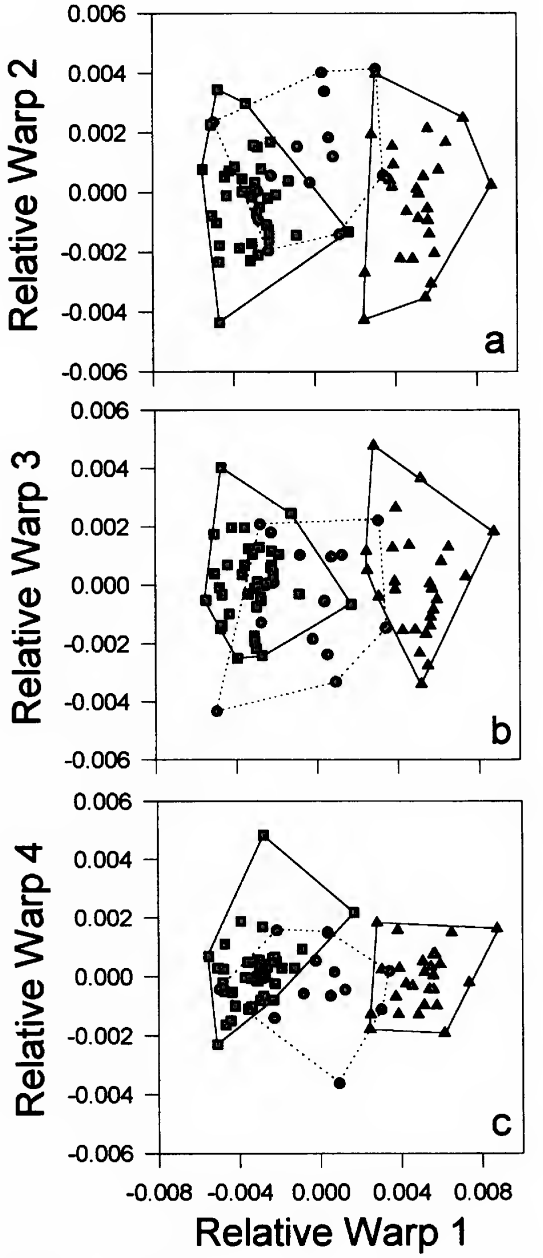

Fig. 8. Bivariate plots of relative warp scores for individual *Epactionotus* specimens. Symbols as in fig. 1. **a**, relative warp 1 vs. relative warp 2; **b**, relative warp 1 vs. relative warp 3; **c**, relative warp 1 vs. relative warp 4.

The results of the relative warps analysis corroborate the discrimination of species as stated above. The first four relative warps comprise more than 77% of the total variance (RW1 = 52.1%, RW2 = 11.2%, RW3 = 9.4%, and RW4 = 4.4%). Plots of the first relative warp versus the second through

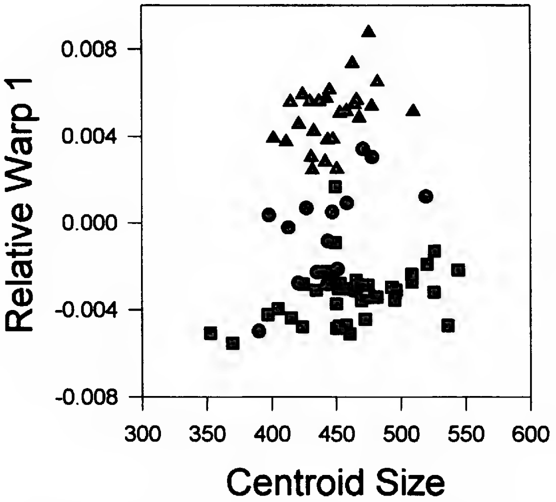

Fig. 9. Bivariate plot of scores for relative warp 1 versus centroid size for *Epactionotus* specimens. Symbols as in fig. 1.

fourth (fig. 8) revealed complete separation between specimen clusters along RW1 for *E. gracilis* and *E. bilineatus*. In all three plots, however, specimens of *E. itaimbezinho* were consistently intermediate relative to those of its congeners. Centroid size is a robust measure of general size, computed as the square root of the average squared distance from each landmark to the centroid of the set of landmarks defining the consensus configuration. The plot of RW1 versus centroid size (fig. 9) shows that the principal discrimination among the species of *Epactionotus* described by the first relative warp is not correlated with specimen size. On the basis of the differences in body shape, coloration, and abdominal platelet distribution, separate species status is warranted for *E. bilineatus*, *E. itaimbezinho,* and *E. gracilis*.

PECTORAL SLIT MORPHOLOGY: Certain hypoptopomatine loricariids share a peculiar slitlike morphology in the region at the base of the pectoral fin that we term the pectoral slit. A putatively homologous slit or pore is present in other siluriform representatives, such as some cetopsid, pseudopimelodid, and pimelodid catfishes; our purpose here is to note the presence, gross morphology, and distribution of the slit in the Hypoptopomatinae. The slit is located between the base of the segmented fin rays and the ventral bony margin of the lateral cleithral process (fig. 10), is roughly 0.2 to 0.5 mm in length, oriented obliquely approximately 30° to the ventral body plane, and forms an opening into the space enclosed by fascia in and around the levator pectoralis and hypaxial musculature posterior to the adductors of the fin rays, the pectoral skeleton, and lateral body wall. In dissections of specimens having the slit, we find the cavity to also contain a large amount of what appears to be adipose or glandular tissue that is absent in hypoptopomatines lacking the slit (however, we find variable amounts of adipose tissue in this region in outgroup loricariids). Our attempts to identify the histology of this tissue have not yet been conclusive. There does not appear to be any capsular epithelial tissue or duct system leading to the opening, which one would expect to observe if the slit were associated with a gland. We found the slit present in both male and female specimens of representatives of all hypoptopomatine genera, with the exception of *Otothyris*, *Schizolecis,* and *Pseudotocinclus*, and have not observed the slit in other Loricariidae; however, we are informed of the presence of a slit in an undescribed *Neoplecostomus* species. The distribution of this feature on the cladogram of generic relationships requires four character-state changes, yet is ambiguous at node 6 and above in the cladogram of Figure 11. Loss of the slit at node 7, with subsequent secondary derivation of the slit in *Microlepidogaster* and *Pseudotothyris* (fig. 11, ACCTRAN optimization) is equally parsimonious with three independent losses of the slit in *Pseudotocinclus, Schizolecis,* and *Otothyris* (DELTRAN optimization). In either optimization scheme, its absence in other loricariids suggests that presence of the pectoral slit is derived for the Hypoptopomatinae within the Loricariidae and its absence is secondarily derived within the Hypoptopomatinae.

Two factors suggest that the presence of the pectoral slit is not simply an artifact of specimen preservation, as might occur from tearing of the skin when abducting the pectoral fin of preserved specimens where alcohol dehydration has caused the skin in this region to become taught. First, we observed that, in many cases, the slit margins are differentially pigmented relative to that of the

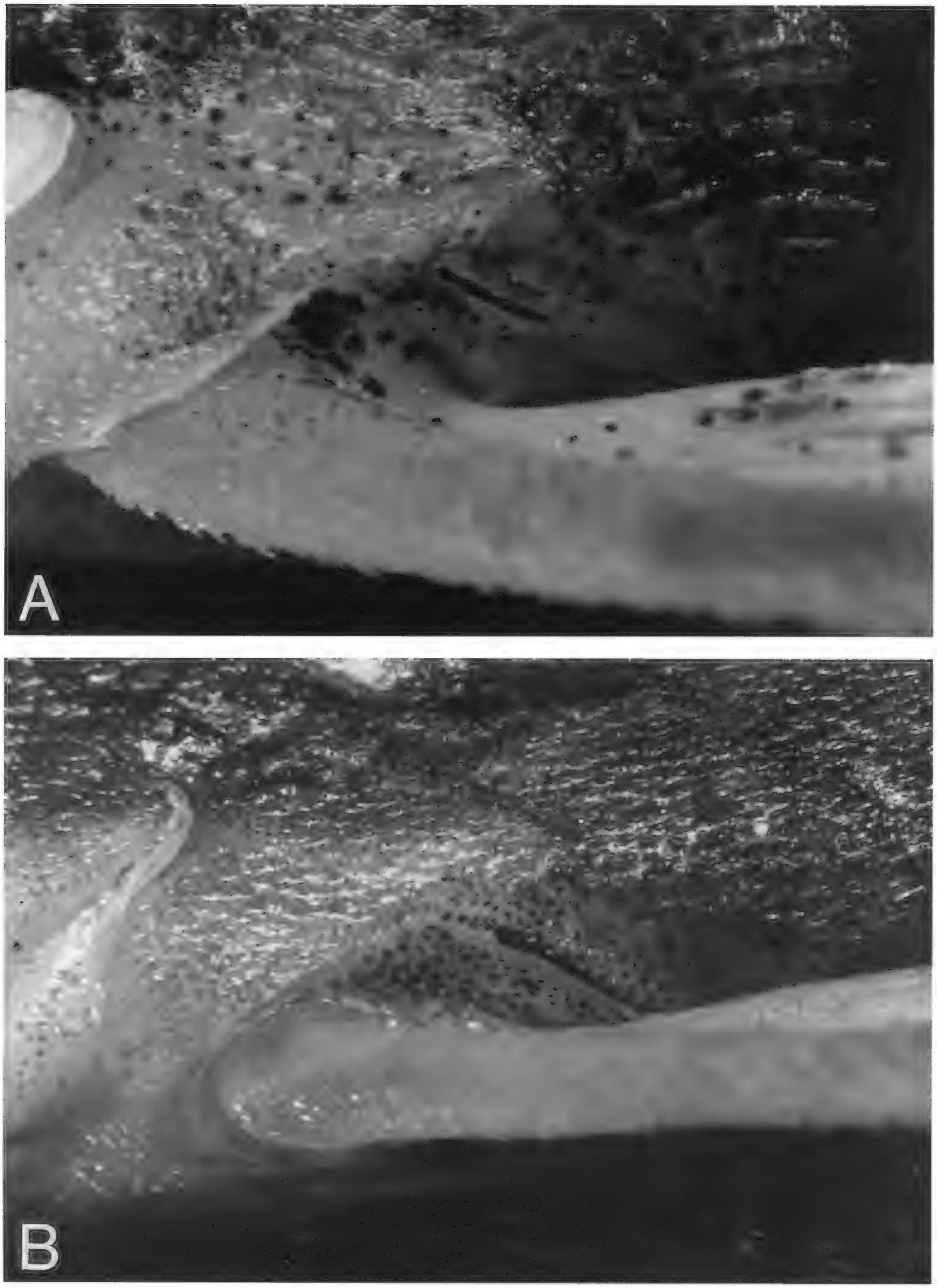

Fig. 10. Pectoral slit morphology, left side, anterior toward left. **A**, *Pseudotothyris obtusa*, ANSP 168959, 25.7 mm SL female; **B**, *Epactionotus gracilis*, paratype, USNM 285878, 38.9 mm SL female.

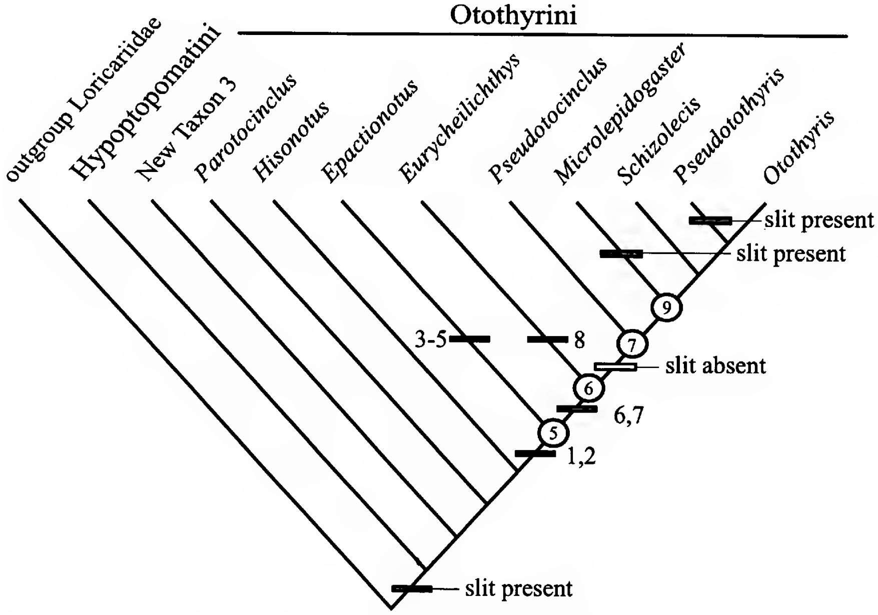

Fig. 11. Cladogram of generic relationships for the tribe Otothyrini, modified from Schaefer (1998). Characters mapped onto the cladogram are numbered as in the text; nodes correspond with the numbering scheme of Schaefer (1998); distribution of the pectoral slit character is shown for ACCTRAN optimization.

skin immediately surrounding the slit. We would not expect to observe this pigmentation so consistently among specimens if the slit were a skin tear. Second, the external topology and orientation of the slit are uniform and consistent within hypoptopomatine genera, but differ slightly among genera. For example, the slit in *Pseudotothyris* (fig. 10A) is small and short relative to that in *Epactionotus* (fig. 10B), yet the relative position and angle of orientation are remarkably similar in the two genera, as well as in all other hypoptopomatines we examined that have the slit. For similar reasons, we would not expect to observe such a degree of topological uniformity if the slit were an artifact. Furthermore, we would not expect the occurrence of the slit to be restricted among loricariids to certain members of the Hypoptopomatinae if it were an artifact of preservation.

At present, we lack the comparative data with which to determine the homology and function of the slit in hypoptopomatine loricariid catfishes. The presence of a slit in both males and females would seem to argue against a possible role in courtship or reproduction; however, even this statement is premature. We offer these limited comments and observations as a stimulus to further research on this structure.

DISTRIBUTION AND RELATIONSHIPS: The pattern of morphometric variation displayed by these three species is congruent with their distribution pattern in southeastern coastal Brazil. The two species completely discriminated by the relative warps analysis, *E. gracilis* and *E. bilineatus*, inhabit rivers located at the northern (rio Araranguá basin) and southern (rio Maquiné drainage) extremes of the distribution of the genus, whereas the morphometrically intermediate species, *E. itaimbezinho,* occurs in the rio Mampituba drainage, which is geographically intermediate to the other two rivers and positioned centrally within the north-south geographic range of the genus (fig. 1). Unfortunately, we have as yet discovered no shared derived features for any two species of *Epactionotus*, a situation that precludes resolution of their interrelationships or the proposition of a historical hypothesis to explain their present distribution. Nevertheless, the distribution of *Epactionotus* and other fishes in the coastal rivers of southern Santa Catarina State suggests shared patterns of species endemism and the possibility of historical drainage connections. Malabarba and Isaia (1992) identified the area comprising the rivers Maquiné, Três Forquilhas, and Mampituba as a general area of species endemism, and to these rivers we add the rio Araranguá in the north. Besides the genus *Epactionotus*, a number of other species and monophyletic fish groups are also endemic to the headwater reaches of these four rivers and are not found in the lower, coastal-plain stretches: *Deuterodon stigmaturus* (Characidae: Lucena and Lucena, 1992 and additional data in MCP fish collection), *Odontostoechus* (Characidae, with one described and a second undescribed species: Luiz Malabarba, personal communication), *Mimagoniates reocharis* (Characidae: Menezes and Weitzman, 1990), an undescribed species of *Rineloricaria* (Loricariidae: personal obs.), and two monophyletic groups of *Hemipsilichthys* species (Loricariidae: Edson Pereira, personal commun.).

The new taxa described here were previously studied by Schaefer (1998), who included them in his reassessment of subfamilial relationships, referring to them as "New Taxon 1" (*Eurycheilichthys limulus*) and "New Taxon 2" (*Epactionotus*). *Epactionotus* was found to be the sister group of a clade formed by *Eurycheilichthys* (including "New Taxon 2"), *Pseudotocinclus, Microlepidogaster*, *Schizolecis*, *Otothyris,* and *Pseudotothyris* (fig. 11). Sequential sister groups to the above clade including *Epactionotus* are *Hisonotus* (which Schaefer, in press, regarded as including all species previously referred to *Microlepidogaster* except the type species, *M. perforatus*), *Parotocinclus*, "New Taxon 3", and finally the tribe Hypoptopomatini.

Epactionotus shares the following two synapomorphies with *Eurycheilichthys* plus members of node 7 (fig. 11): (1) first dorsal-fin spinelet reduced; (2) accessory teeth present (subsequently reversed in members of node 7; alternatively and equally parsimoniously regarded as independently derived in *Epactionotus* and *Eurycheilichthys*). Three synapomorphies were found for the species of *Epactionotus*: (3) neural spine of the seventh vertebra not contacting the nuchal plate, but rather contacting an unpaired predorsal plate anterior to the nuchal plate; (4) dorsal fin located more posteriorly relative to the supraoccipital, with the vertebral support of the dorsal-fin first proximal radial provided by the eighth centrum (posterior dorsal fin placement shared with *Microlepidogaster*, where the ninth vertebral centrum supports the first dorsal-fin proximal radial); and (5) absence of an expanded fleshy flap on the dorsal surface of the first pelvic-fin ray of males (independently derived in *Schizolecis* and in a subclade of the Hypoptopomatini).

At the next level in the cladogram (fig. 11: node 6), *Eurycheilichthys* shares the following two synapomorphies with *Pseudotocinclus* plus members of node 9: (6) median rostral plate secondarily absent, snout tip comprises numerous small, separate platelets; (7) snout odontodes secondarily reduced in size and of roughly equivalent size, shape, and arrangement compared to those on the remainder of the head and trunk. *Eurycheilichthys* was diagnosed by Reis and Schaefer (1992) as (8) having seven branched pectoral-fin rays; accessory ceratobranchial flange reduced to a small, slender uncinate process; absence of the filamentous gillrakers on oral surfaces of the hyobranchial skeleton, and having a greatly expanded lower lip. Considering the distribution of features in *E. limulus*, only the presence of seven branched pectoral-fin rays stands as a synapomorphy of the genus (fig. 11: character 8); the other characters are here relegated to autapomorphies of *E. pantherinus*.

Both species of *Eurycheilichthys* are allopatric in distribution with respect to one another (fig. 1), occurring in the separated headwaters of the Uruguay (*E. pantherinus*) and Jacuí rivers (*E. limulus*), which drain to the west and southeast, respectively. Headwaters of both rivers are in close proximity in some places and stream capture events are likely to have occurred during drainage evolution (Beurlen, 1970). Other examples of shared sister-taxa relationships between the Uruguay and Jacuí rivers have been demonstrated for *Gymnogeophagus* (Cichlidae: Reis and Malabarba, 1988; Wimberger et al., 1998) and *Parapimelodus* (Pimelodidae: Lucena et al., 1992). Subsequent to the description of *Eurycheilichthys pantherinus*, two additional lots of this species have been collected in the upper Uruguay: MCP 18775, from rio Buricá, Independência, Rio Grande do Sul State and MCP 20248, from rio Santana in Ouro Verde, Cambará do Sul, Rio Grande do Sul State (localities 1 and 2, fig. 1).

REVISED KEY TO GENERA OF OTOTHYRINI

1A. Trunk from posterior margin of dorsal-fin base to caudal fin rectangular; caudal peduncle sharply square in cross section . . . . *Pseudotocinclus* Nichols
1B. Trunk from posterior margin of dorsal-fin base to caudal fin not rectangular; caudal peduncle round or ovoid in cross section 2
2A. Posterodorsal margin of pterotic-supracleithrum elongate, distance from its posterior tip to posterior orbit margin approximately 2.5 times orbit diameter; lateral opening of swimbladder capsule large 3
2B. Posterodorsal margin of pterotic-supracleithrum short, distance from its posterior tip to posterior orbit margin approximately 2.0 times orbit diameter; lateral opening of swimbladder capsule small 4
3A. Twelve branched caudal-fin rays; odontodes of posterodorsal head region arranged in rows; sphenotic without portion of infraorbital canal; canal absent from ventrolateral cheek plate . . . . *Otothyris* Myers
3B. Fourteen branched caudal-fin rays; odontodes of posterodorsal head region not arranged in rows; sphenotic bearing portion of infraorbital canal; canal present in ventrolateral cheek plate . . . . *Pseudotothyris* Britski and Garavello
4A. Seven branched pectoral-fin rays . . . . *Eurycheilichthys* Reis and Schaefer
4B. Six branched pectoral-fin rays 5
5A. Caudal fenestrum present anterior to notch between hypurals 2 and 3; adipose fin present . . . . *Parotocinclus* Eigenmann and Eigenmann
5B. Caudal fenestrum absent; adipose fin absent 6
6A. Accessory patch of unicuspid teeth present on both premaxilla and dentary . . . . *Epactionotus,* new genus
6B. Accessory patch of unicuspid teeth absent from premaxilla and dentary 7
7A. Pectoral bridge completely exposed ventrally 8
7B. Pectoral bridge exposed only laterally . . . . *Schizolecis* Britski and Garavello
8A. Rostrum with enlarged odontodes; plates forming the lateral rostral margins thickened . . . . *Hisonotus* Eigenmann and Eigenmann
8B. Rostrum without enlarged odontodes; plates forming the lateral rostral margins thin . . . . *Microlepidogaster* Eigenmann and Eigenmann

ACKNOWLEDGMENTS

We are grateful to Heraldo Britski (MZUSP), Richard Vari and Susan Jewett (USNM), Julio Garavello (UFSCar), and Luiz Malabarba (UFRGS) for providing specimens. José F. Pezzi da Silva and Erica Detwiler provided important technical assistance at MCP and AMNH, respectively. The manuscript benefited from the review and valuable suggestions of Luiz Malabarba, Thomas Munroe, and Stanley Weitzman. This project received financial support from the following grants to R. E. Reis: CNPq 305344/87-0, FAPERGS 94/00584-2, and CAPES BEX 0959/95-5.

REFERENCES

Beurlen, K.
1970. Geologie von Brasilien. Berlin: Gebrüder Borntraeger.
Boeseman, M.
1968. The genus *Hypostomus* Lacépède, 1803, and its Surinam representatives (Siluriformes, Loricariidae). Zool. Verh. 99:1–89.
Bookstein, F. L.
1991. Morphometric tools for landmark data. Geometry and biology. New York: Cambridge Univ. Press.
1996. Standard formula for the uniform shape component in landmark data. *In* L. F. Marcus, M. Corti, A. Loy, G. Naylor and D. E. Slice (eds.), Advances in morphometrics. Proceedings of the 1993 NATO Advanced Studies Institute on Morphometrics in Ii Ciocco, Italy., New York: Plenum Press.

Britski, H. A.
1997. Descrição de um novo gênero de Hypoptopomatinae, com duas espécies novas (Siluriformes, Loricariidae). Papéis Avulsos de Zool. 40(15): 231–255.

Britski, H. A., and J. C. Garavello
1984. Two new southeastern Brazilian genera of Hypoptopomatinae and redescription of *Pseudotocinclus* Nichols, 1919 (Ostariophysi, Loricariidae). Papeis Avulsos de Zool. 35(21): 225–241.

Chardon, M.
1968. Anatomie comparée de l'appareil de Weber et des structures connexes chez les Siluriformes. Ann. Mus. R. Afrique Centrale, ser. 8, 169: 1–277.

Eigenmann, C. H., and R. S. Eigenmann
1890. A revision of the South American Nematognathi or cat-fishes. Occas. Pap. Cal. Acad. Sci. 1: 1–508.

Garavello, J. C., Britski, H. A., and S. A. Schaefer
1998. Systematics of the genus *Otothyris* Myers 1927, with comments on geographic distribution (Siluriformes, Loricariidae, Hypoptopomatinae). Am. Mus. Novitates 3222: 19 pp.

Isbrücker, I. J. H.
1979. Les Poissons de la famille des Loricariidés ou Poissons-Chats cuirassés. Rev. fr. Aquariol. 6(4): 109–124.
1980. Classification and catalogue of the mailed Loricariidae. Versl. Tech. Gegevens, Inst. Taxon. Zool. Univ. Amsterdam 22: 1–180.
1987. *Spectracanthicus murinus*, nouveaux genre et espece de Poisson-Chat cuirasee du Rio Tapajos, Est. Para, Bresil, avec des remarques sur d'autres genres de Loricariides (Pisces, Siluriformes, Loricariidae). Rev. fr. Aquariol. 13(4): 93–98.

Leviton, A. E., R. H. Gibbs, Jr., E. Heal, and C. E. Dawson
1985. Standards in ichthyology and herpetology: Part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. Copeia 1985: 802–832.

Lucena, Z. M. S., and C. A. S. Lucena
1992. Revisão das espécies do gênero *Deuterodon* Eigenmann, 1907 dos sistemas costeiros do sul do Brasil com a descrição de quatro espécies novas (Ostariophysi, Characiformes, Characidae). Comun. Mus. Ciênc. PUCRGS Sér. Zool. 5(9): 123–168.

Lucena, C. A. S., L. R. Malabarba, and R. E. Reis
1992. Resurrection of the Neotropical pimelodid catfish *Parapimelodus nigribarbis* (Boulenger, 1889) (Pisces: Siluriformes). Copeia 1992(1): 138–146.

Malabarba, L. R., and E. A. Isaia
1992. The fresh water fish fauna of the rio Tramandai drainage, Rio Grande do Sul, Brazil, with a discussion of its historical origin. Comun. Mus. Ciênc. PUCRGS Sér. Zool. 5(12): 197–223.

Menezes, N. A., and S. H. Weitzman
1990. Two new species of *Mimagoniates* (Teleostei: Characidae: Glandulocaudinae), their phylogeny and biogeography and a key to glandulocaudin fishes of Brazil and Paraguay. Proc. Biol. Soc. Washington 103: 380–426.

Regan, C. T.
1904. A monograph of the fishes of the family Loricariidae. Trans. Zool. Soc. London 17(3): 191–350.

Reis, R. E.
1997. Revision of the neotropical catfish genus *Hoplosternum* (Ostariophysi: Siluriformes: Callichthyidae), with the description of two new genera and three new species. Ichthyol. Explor. Freshwaters 7(4): 299–326.

Reis, R. E., and L. R. Malabarba
1988. Revision of the Neotropical cichlid genus *Gymnogeophagus* Ribeiro, 1918, with descriptions of two new species (Pisces, Perciformes). Rev. Bras. Zool. 4(4): 259–305.

Reis, R. E., and S. A. Schaefer
1992. *Eurycheilus pantherinus* (Siluroidei: Loricariidae), a new genus and species of Hypoptopomatinae from southern Brazil. Copeia 1992(1): 215–223.
1993. *Eurycheilichthys* nom. nov., a substitute name for *Eurycheilus* Reis and Schaefer, 1992 (Siluroidei: Loricariidae). Ibid. 1993(30): 894.

Rohlf, F. J.
1993. Relative warp analysis and an example of it application to mosquito wings. *In* L. F. Marcus, E. Bello, and A. Garcia-Valdecasas (eds.), Contributions to morphometrics. Mus. Nac. Cienc. Nat. (CSIC) Vol. 8, Madrid.

Schaefer, S. A.
1988. Homology and evolution of the opercular series in the loricarioid catfishes (Pisces: Siluroidei). J. Zool. 214: 81–93.
1991. Phylogenetic analysis of the loricariid subfamily Hypoptopomatinae (Pisces: Siluroidei: Loricariidae), with comments on generic diagnoses and geo-

graphic distribution. Zool. J. Linn. Soc. 102: 1–41.

1996. *Nannoptopoma*, a new genus of loricariid catfishes (Siluriformes: Loricariidae) from the Amazon and Orinoco river basins. Copeia 1996(4): 913–926.

1997. The Neotropical cascudinhos: Systematics and biogeography of the *Otocinclus* catfishes (Siluriformes: Loricariidae). Proc. Acad. Nat. Sci. Philadelphia 148: 1–120.

1998. Conflict and resolution: Impact of new taxa on phylogenetic studies of the neotropical cascudinhos (Siluroidei: Loricariidae). *In* L. R. Malabarba, R. E. Reis, R. P. Vari, C. A. S. Lucena, and Z. M. S. Lucena (eds.), Phylogeny and classification of neotropical fishes. Mus. Ciênc. Tecn. PUCRGS, Porto Alegre.

Schaefer, S. A., and F. Provenzano R.

1998. *Niobichthys ferrarisi*, a new genus and species of armored catfish from southern Venezuela (Siluriformes: Loricariidae). Ichthyol. Explor. Freshwaters 8(3): 221–230.

Schwarzbold, A., and A. Schafer

1984. Gênese e morfologia das lagoas costeiras do Rio Grande do Sul, Brasil. Amazoniana 9(1): 87–104.

Taylor, W. R., and G. C. Van Dyke

1985. Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study. Cybium 9(2): 107–119.

Wimberger, P. H., R. E. Reis, and K. Thornton

1998. Molecular phylogenetics and the evolution of parental care and mating systems in *Gymnogeophagus*. *In* L. R. Malabarba, R. E. Reis, R. P. Vari, C. A. S. Lucena, and Z. M. S. Lucena (eds.), Phylogeny and Classification of Neotropical Fishes. Mus. Ciênc. Tecn. PUCRGS, Porto Alegre.

Recent issues of the *Novitates* may be purchased from the Museum. Lists of back issues of the *Novitates* and *Bulletin* published during the last five years are available at World Wide Web site http://nimidi.amnh.org. Or address mail orders to: American Museum of Natural History Library, Central Park West at 79th St., New York, NY 10024. TEL: (212) 769-5545. FAX: (212) 769-5009. E-MAIL: scipubs@amnh.org

♾ **This paper meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).**